

# WISCONSIN FOREST MANAGEMENT GUIDELINES

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A purple logging truck is shown from a low angle, heavily loaded with large, rough-barked logs. The truck is parked on a dirt forest road. The background shows a dense green forest under a clear blue sky. The truck's large, treaded tires are prominent in the foreground.

# **Chapter 11**

## **FOREST ROAD CONSTRUCTION AND MAINTENANCE**



## CHAPTER 11 — FOREST ROAD CONSTRUCTION AND MAINTENANCE

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Roads, skid trails and landings are all part of a forest transportation system (skid trail and landing BMPs are covered in Chapter 12: Timber Harvesting). Roads connect the forestland to existing public roads. They provide forest access for such activities as managing timber, improving fish and wildlife habitat, fighting fires, and recreation.

Forest roads located, constructed or maintained poorly are the largest source of nonpoint source pollution from forest management activities. Roads over steep slopes, erodible soils, or stream crossings hold the greatest potential for degrading water quality.

There are three types of forest roads: temporary roads, permanent seasonal roads, and permanent all-season forest roads. Make sure to identify the type of road system you need during your planning phase.

- **Temporary Roads:** These are the most common type of forest road. They are designed and constructed for short-term use during a specific project such as timber harvesting. These roads are used only when the ground is frozen or firm. When the project is complete, the temporary road is closed, all stream crossing structures are removed, and the road is naturally or artificially revegetated.
- **Permanent Seasonal Roads:** Maintained as part of the permanent road system, seasonal roads are designed for use only when the ground is frozen or firm. These roads are generally narrower than all-season roads, built to lower engineering standards, and have minimal surface gravel.
- **Permanent All-season Forest Roads:** These roads usually have gravel surfaces and are designed for year-round use. However, there may be some restrictions on use at various times of the year.

### Integrated Resource Management Considerations

A well-planned access system is a sound method of reducing erosion and sedimentation in areas requiring frequent or temporary access. Proper location and construction of roads will provide for safety, longer operating periods, lower maintenance and operating costs, and minimal impacts to forest resources.



*Figure 11-1: Seeding can be as easy as spreading grass seed by hand as this landowner is doing on his freshly-graded woods road. Use non-invasive species and certified weed-free seed.*

Servicing as many acres of forest with as few roads as possible is a sound method of reducing impacts to forest resources from road construction.

### FACTORS IN DECISION-MAKING

- The number, size and design of forest access roads will be influenced by the frequency of access, amount of anticipated traffic, seasons during which access is required, and safety concerns.
- Distribution of necessary management activities will affect the number and location of access roads.
- Choices regarding road construction standards and maintenance activities will be influenced by site characteristics, and the value of the resources served. Culverts and ditches may be necessary with any road construction technique.
- Surfacing can be the major cost of low-volume road construction. Alternatives should be evaluated according to expected use and potential impact on sediment load. Where grades make the potential for surface erosion significant, the road should be surfaced with materials such as crushed rock, compacted gravel, sod, or asphalt that will minimize potential water quality and soil productivity impacts.



## MINIMIZING THE IMPACTS OF ROADS

- Visual impacts and excessive noise can result from poor design, construction and maintenance of forest access roads. Take into account the following considerations when planning to reduce noise and visual impacts associated with the design and use of forest access roads:
  - Noise from traffic, especially large trucks, buses and heavy equipment.
  - Potential increased costs of building forest access roads to accommodate visual quality concerns, and potential increased costs of using existing roads that require traveling greater distances.
  - The limited road construction season that generally coincides with the tourist season.
  - Traffic during wet periods that can increase maintenance needs, and create unsightly ruts and mudholes.
- Visual impacts and noise impacts created by gravel pits are not compatible with recreational user sensitivities. Take into account the following considerations when planning to reduce noise and unsightliness related to gravel pits:
  - Local sources of gravel are necessary for efficient, cost-effective road building and maintenance.
  - Recreational use of gravel pits may cause conflicts.
- Site-specific soil, topographic and forest inventory information will assist resource managers or landowners in planning road location and layout. For more information, see the Resource Directory.
- Because roads take soils out of production, effort should be made to keep the length and width of roads to a minimum without sacrificing safety.
- To minimize road mileage and reduce costs, coordination with adjacent landowners may be desirable.
- The greatest potential for soil erosion occurs immediately after construction. Disturbed areas should be shaped and stabilized as soon as possible to minimize erosion potential.
- Seed disturbed areas (landings and skidroads) as soon as feasible in order to re-establish desirable species, and retard possible invasion by non-native invasive species.

## MAINTENANCE NEEDS

- The purpose of maintenance procedures is to ensure measures taken to minimize impacts on forest resources are working, and continue to work into the future. Surfacing materials and the amount of use determine the level of maintenance required.
- Roads that are open for use require more maintenance than roads that are closed to vehicular traffic. Inactive roads (roads currently not in use) whether closed temporarily or permanently, require occasional work to reduce potential impacts on streams, lakes, wetlands, and seasonal ponds.
- Road layout, construction methods and erosion, and access control all contribute to the longevity, utility, safety, and maintenance cost of roads.
- Monitor for non-native invasive species, control their spread, and eradicate them if possible. Clean equipment as needed.

## PROTECTING WATER QUALITY AND WATER FLOW

- Incorporating guidelines to protect water quality into overall road project design can minimize the potential impact of wetland roads on water quality, as well as alterations to normal water flow patterns.
- Effective road construction techniques minimize the disturbance to the natural flow of water over the landscape, and ensure the structural integrity of the road embankment.

The goals are to provide a simple road structure of adequate strength to support heavy vehicle traffic, and provide drainage structures to pass water at its normal level through the road corridor.

## UPLAND FOREST ROADS

### BMPs: Planning, Location and Design

Decisions made at the planning stage will affect a road's construction costs, long-term maintenance needs, service life, and the amount of nonpoint source pollution it causes. Loggers and landowners should plan, locate and design the road system together.

- ✓ Plan road systems that minimize the number, width and length of roads to limit the total area of the site disturbed. Remember to:
  - Consider future uses of the road system
  - Coordinate development with adjoining landowners when possible; and
  - use temporary roads where practical
- ✓ Use existing roads when they provide the best long-term access. Consider relocating existing roads if doing so improves access and reduces environmental impacts. Reconstruct existing roads to provide adequate drainage and safety. Do not disturb stable road surfaces.
- ✓ Select road locations that allow for drainage away from the road.
- ✓ Minimize the number of stream crossings.
- ✓ Identify optimum stream crossing locations before locating the rest of the road. Optimum locations

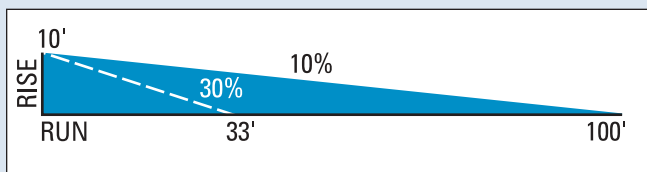


Figure 11-2:  $\text{Road Grade \%} = \text{Rise} \div \text{Run} \times 100$ .

include straight and narrow stream channels with low banks and firm rocky soil. Roads should approach streams with the least gradient possible.

- ✓ Where possible, locate roads on well-drained soils.
- ✓ Locate roads outside riparian management zones except at stream crossings. For more information, see Chapter 5: Riparian Areas and Wetlands.
- ✓ Road grades should not exceed 10 percent. If road grades greater than 10 percent are necessary, limit grade length to minimize erosion, or break the grade using drainage structures (see "Drainage Structures" on page 149). Graveling the road surface on steep grades can also help maintain stability. Note: Optimum road grades should be less than five percent (see Figure 11-2).
- ✓ Locate roads to follow natural contours and minimize cut-and-fills. Balance cut-and-fills to minimize the need for fill or removing excess materials (see Figure 11-3).

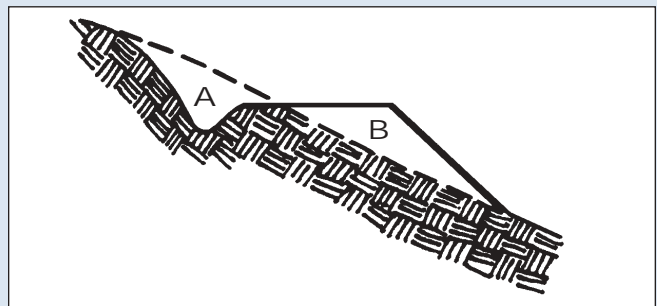


Figure 11-3: A side-hill cross-section illustrating how cut materials (A) equals fill materials (B).

### REDUCING VISUAL IMPACTS DUE TO ALIGNMENT AND LOCATION OF ROADS

- Minimize the number of roads approaching travel routes or recreation areas.
- Locate roads and trails to minimize visibility from nearby vantage points such as scenic overlooks, streams and lakes.
- Reduce visual penetration with appropriate curves in the road alignment.
- Minimize total road mileage and ground disturbance required to meet landowner objectives and anticipated traffic loads.
- Avoid tracking mud onto highways by using appropriate road surface material.

## STREAM CROSSING DESIGN AND CONSTRUCTION

Operating equipment in or near perennial or intermittent stream channels may add sediment directly to streams. Stream crossings poorly located or constructed may erode streambanks.

As roads approach a stream crossing, proper road drainage is critical to avoid sedimentation in streams. Three common stream crossing structures include culverts, bridges and fords.

Stream crossings must be designed, constructed and maintained to safely handle expected vehicle loads and minimize disturbance of streambanks, channels, and, ultimately, aquatic organisms. Consider streambed material, stream size, storm frequency, flow rates, intensity of use (permanent or temporary), and the passage of fish when planning crossings. The USDA Natural Resources and Conservation Service, your local land conservation department, or a private consultant can help with designing fords and culverts. To design a bridge, contact a private consultant or experienced contractor.



*Figure 11-4: Seeding a logging road helps prevent soil erosion while providing wildlife food and habitat. This road curves after entering the woods and thereby reduces visual penetration.*

### BMPs: Fords

Use fords for crossing dry streambeds, or where fording would cause minimal water quality impacts.

- ✓ Locate fords where streambanks are low.

- ✓ Streambeds should have a firm rock or gravel base. Otherwise, install stabilizing material such as reinforced concrete planks, crushed rock, riprap, or rubber mats on streambeds.



*Figure 11-5: A ford was approved for this stream crossing because the stream banks are low, and the streambed is gravel.*



## BMPs: Stream Crossings

- ✓ A permit is required to construct a ford or install a culvert/bridge across any navigable intermittent or perennial stream. A stream is navigable if it has bed and banks, and it is possible to float a canoe or other small craft in the waterway on a regular reoccurring basis – even if only during spring runoff. Streams identified on current U.S. Geological Survey (USGS) topographical maps (7.5 minute/1:24,000 scale) should be considered navigable. Other lakes and streams may be considered navigable by a Wisconsin DNR water management specialist. If you have a question about navigability, contact a Wisconsin DNR water management specialist.
- ✓ For temporary stream crossings for skid trails, see the Stream Crossings for Skidding section in Chapter 12: Timber Harvesting.
- ✓ Use soil stabilization practices on exposed soil at stream crossings. Use seed and mulch, and install temporary sediment control structures such as straw bales or silt fences immediately following construction to minimize erosion into streams. Maintain these practices until the soil is permanently stabilized (see Soil Stabilization, page 152).
- ✓ Design, construct and maintain stream crossings to avoid disrupting the migration or movement of fish and other aquatic life. Bridges or arch culverts that retain the natural stream bottom and slope are preferred for this reason.
- ✓ Install stream crossings using materials that are clean, non-erodible and non-toxic.
- ✓ Install stream crossing structures at right angles to the stream channel.
- ✓ Minimize channel changes and the amount of excavation or fill needed at the crossing.
- ✓ Limit construction activity in the water to periods of low or normal flow. Keep use of equipment in the stream to a minimum.
- ✓ Construct a bridge or place fill directly over a culvert higher than the road approach to prevent surface runoff from draining onto the crossing structure and into the stream (see Figure 11-6).
- ✓ Divert road drainage into undisturbed vegetation, preferably outside the RMZ, so the drainage does not directly enter the stream (see Figure 11-7 and Diversion Structures on page 149).
- ✓ Stabilize approaches to bridge, culvert and ford crossings with aggregate or other suitable material to reduce sediment entering the stream.
- ✓ Anchor temporary structures on one end with a cable or other device so they do not float away during high water. Install them so they can be easily removed when no longer used, regardless of the season.



Figure 11-6: Use of fill when placing a culvert.



Figure 11-7: Example of a diversion ditch.



## BMPs: Pipe Culverts for Stream Crossings

- ✓ Install pipe culverts long enough so that road fill does not extend beyond the ends of a culvert.
- ✓ Install permanent culverts that are large enough to pass flood flows, and are a minimum of 12 inches in diameter. Culverts that are too small can plug up with debris and result in the road washing out, or in flooding upstream. Wisconsin law states that the landowner and/or contractor are responsible to obtain a flood easement from any affected property owners upstream of culvert crossings that are not designed to pass the 100-year flood. The USDA Natural Resources and Conservation Service, your local land conservation department or a private consultant (i.e., engineer or registered land surveyor) can help with sizing culverts.
- ✓ Install culverts so there is no change in the stream bottom elevation. Culverts should not cause damming or pooling (see Figure 11-8).
- ✓ Firmly compact fill material around culverts, particularly around the bottom half. Cover the top of culverts with fill to a depth of one-third of the pipe diameter or at least 12 inches, whichever is greater, to prevent crushing (see Figure 11-9).
- ✓ Use riprap around the inlet of culverts to prevent water from eroding and undercutting the culvert. For permanent installations, use filter fabric under the riprap. In addition, consider using flared-end culvert sections for inlets (see Figure 11-10).
- ✓ Keep culverts clear and free of debris so that water can pass unimpeded at all times. This is especially important in areas where beaver are present.

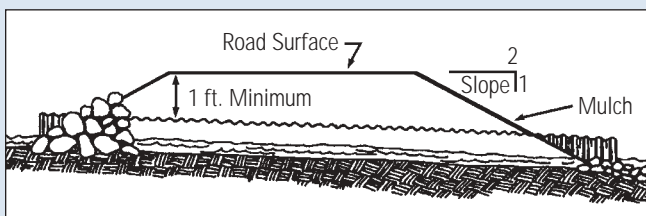


Figure 11-8: Install culverts so there is no change in the stream bottom elevation.

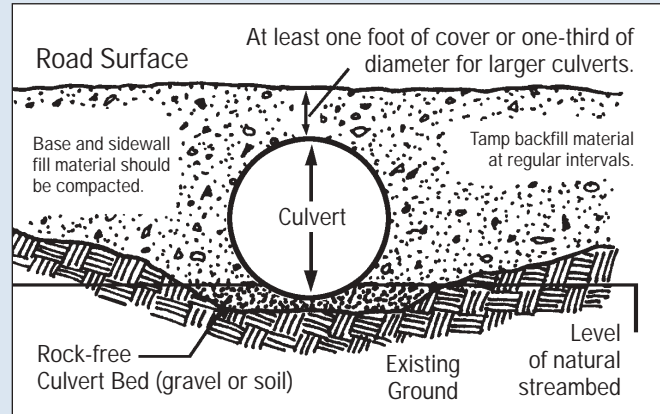


Figure 11-9: Installation of culverts.

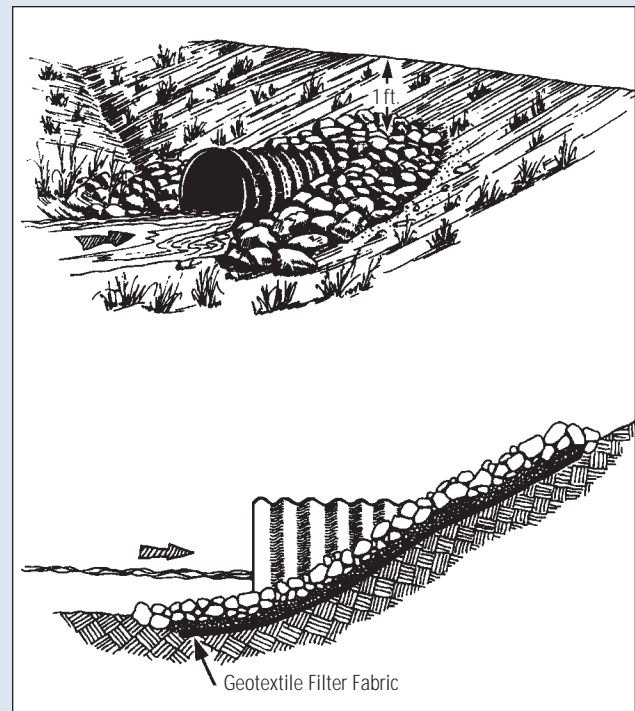


Figure 11-10: Use riprap around the inlet of culverts. Also use geotextile filter fabric for permanent installations.



*Figure 11-11: The number and size of culverts depends on stream size, rate of flow, and flood potential.*



*Figure 11-12: This box culvert, made from two-inch lumber, helps to divert water runoff to the road's downhill side.*



*Figure 11-13: Pulpwood stacked above the culvert elevates this woods road, and reduces the approach grade at the stream crossing. This helps minimize erosion potential from water runoff.*



*Figure 11-14: This culvert, half-full of sediment, should be cleaned out to enable it to handle water runoff. Periodic maintenance is essential if water handling structures are to function properly.*



## ROAD CONSTRUCTION AND DRAINAGE

The most effective method to control erosion on forest roads is to keep water from accumulating on the road surface. Fast-moving water can easily erode soil from

road surfaces and ditches, but road erosion can be controlled when water drains off the road surface, and is dispersed into vegetation and ground litter.



Figures 11-15 and 11-16: This road shows past erosion and grading will clear up the problem temporarily. However, high berms (right photo) alongside the road prohibit water from running off, and erosion is likely to reoccur. A ditch is needed to properly handle the water runoff.

### BMPs: Road Construction and Drainage

- ✓ Design and construct roads to remove water from road surfaces to keep roads dry and structurally sound. Figure 11-17 shows three common designs: crowned, outsloped and insloped. Install insloped roads with ditches and adequate cross-drainage. Outsloped roads (usually outsloped one to two percent) are less expensive to construct and maintain; use them on roads with moderate gradients and stable soils.
- ✓ Construct stable cut-and-fill slopes that will revegetate easily, either naturally or artificially.
- ✓ Do not bury debris in the road base. It causes uneven settling that can lead to erosion and frost-heaving that creates mud holes.
- ✓ Compact the road base material or allow it to settle before using the road to reduce the amount of water that soaks into it. This will increase the road's carrying capacity, reduce road maintenance, and reduce erosion.

- ✓ Surface the road with gravel where steep grades, erodible soils or high-traffic volume make the potential for surface erosion significant.
- ✓ Locate gravel pits outside RMZs using proper location, development and soil stabilization practices to minimize erosion from the pits.

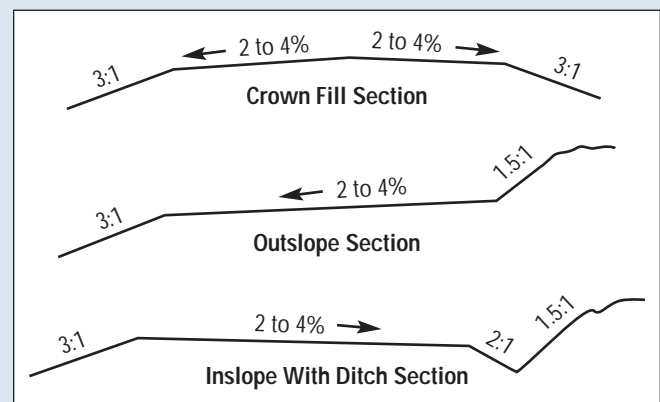


Figure 11-17: Typical road designs for drainage and stability.



*Figure 11-18: This waterbar, placed at the proper angle to the road, will intercept runoff water and direct it into the adjoining vegetation.*

#### **REDUCING VISUAL IMPACTS OF ROAD CLEARINGS**

- Utilize merchantable timber within road clearings.
- Burn, screen or bury road-clearing debris such as stumps, rocks and boulders, so it is not visible from travel routes or recreation areas.
- Move cleared debris outside of the travel route right-of-way so it is minimally apparent.
- Avoid creating a corridor of debris.
- Do not leave jackstrawed or overturned stumps in the immediate foreground.
- Reduce the height of dozed clearing debris during road construction.

#### **REDUCING NOISE AND VISUAL IMPACTS OF GRAVEL PITS AND BORROW AREAS**

- Locate borrow pits and crushing operations out of the visible corridor as much as possible.
- Screen pits from travel routes or recreation areas using existing vegetation or landscape berms.
- Reduce noise in early morning, late evening and other appropriate times whenever possible.
- Develop gravel or borrow pits from the back to the front of pits (moving toward the predominant view or vantage point).
- Rehabilitate pits upon completion of use.



## DRAINAGE STRUCTURES

### BMPs: Drainage Structures

Road-drainage structures include cross-drains (pipe culverts, open-top culverts, broad-based dips, and waterbars) and water-diversion structures. Cross-drains allow water from roadside ditches to move from one side of the road to the other.

- ✓ Where necessary to protect water quality, install road-drainage structures to remove storm water or seepage from the road surface and ditches. Space these structures at intervals close enough to

minimize waterflow volume and speed, avoiding ditch erosion. As road grades increase, use drainage structures more often (see Table 11-1).

- ✓ Where necessary, provide erosion protection for outflows from road-drainage structures to minimize erosion and disperse the water, allowing it to soak into the soil. Riprap, mulch and/or seeding may be necessary (see Soil Stabilization, page 152).

ROAD GRADE	DISTANCE BETWEEN WATERBARS	DISTANCE BETWEEN BROAD-BASED DIPS AND CROSS-DRAIN CULVERTS
1%	400 Feet	500 Feet
2%	250 Feet	300 Feet
5%	130 Feet	180 Feet
10%	80 Feet	150 Feet
15%	50 Feet	130 Feet
25% +	40 Feet	110 Feet

Table 11-1: Recommended distances between drainage structures on forest roads and skid trails.



Figure 11-19: This truck haul road has just been graded at the close of timber harvesting activities. Water diversions, seed and gate closures will be completed next.



Figure 11-20: A seeded logging road with a properly located gate to limit motorized access mark the end of this timber sale.

## BMPs: Pipe Culverts for Cross-drains

- ✓ Install pipe culverts to provide cross-drainage on road grades at regular intervals immediately above steep grades, below bank seepages, and where water will run onto log landings or forest roads.
- ✓ Install pipe culverts long enough so that road fill does not extend beyond the end of a culvert.
- ✓ Install cross-drain pipe culverts at grades at least two percent more than the ditch grade, and angled 30° to 45° to improve inlet efficiency (see Figure 11-21).
- ✓ Select the size of cross-drain culverts according to the size of the road and area drained by the ditch. To avoid clogging, permanent culverts should be at least 12 inches in diameter. The USDA Natural Resources and Conservation Service, your local land conservation department, or a private consultant (i.e., engineer or registered land surveyor) can help with sizing culverts.
- ✓ Install pipe culverts on a surface of compacted granular material. Firmly compact fill material around culverts, particularly around the bottom half. Cover the top of the culvert with fill to a depth of one-third of the pipe diameter, or at least 12 inches (whichever is greater) to prevent crushing (see Figure 11-9, page 145).

- ✓ Use riprap around the inlet of culverts to prevent water from eroding and undercutting the culvert.

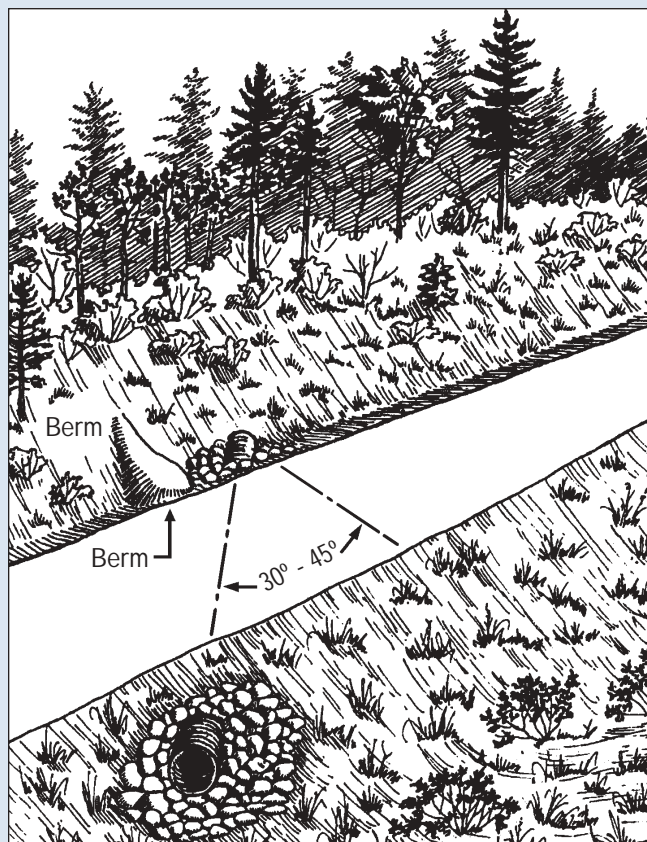


Figure 11-21: Cross-drain culvert.

## BMPs: Open-top Culverts

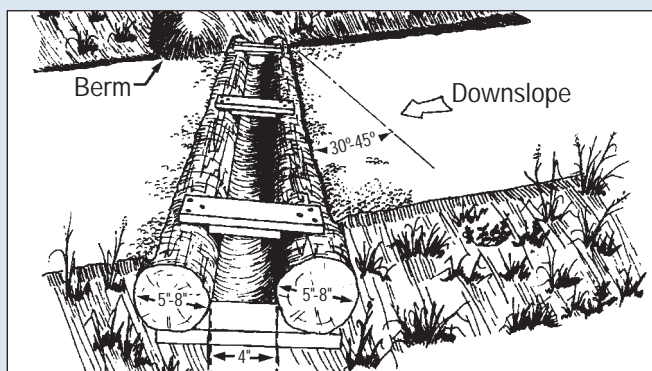


Figure 11-22: Open-top log culvert.

Open-top culverts provide cross-drainage and road-surface drainage, and are usually installed on seasonal or temporary roads (see Figure 11-22).

- ✓ Install open-top culverts to provide cross-drainage immediately above steep grades, below bank seepages, where water will run onto log landings or forest roads, and on road grades at regular intervals.
- ✓ Clean open-top culverts frequently since they easily fill in with debris.



## BMPs: Broad-based Dips

Broad-based dips can provide cross-drainage and road-surface drainage for roads and skid trails with a gradient of 15 percent or less. Broad-based dips can be used instead of culverts, usually at lower cost and with lower maintenance. Dips are not used for draining seeps, or for intermittent or permanent streams (see Figure 11-23).

- ✓ Construct broad-based dips deep enough to provide adequate drainage and wide enough to allow trucks and equipment to pass safely.
- ✓ Place a surface of crushed stone or gravel on the dip, and mound for soils and conditions where rutting may occur.

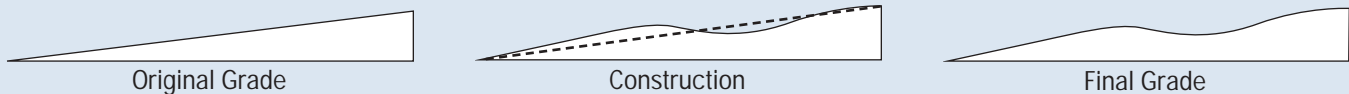
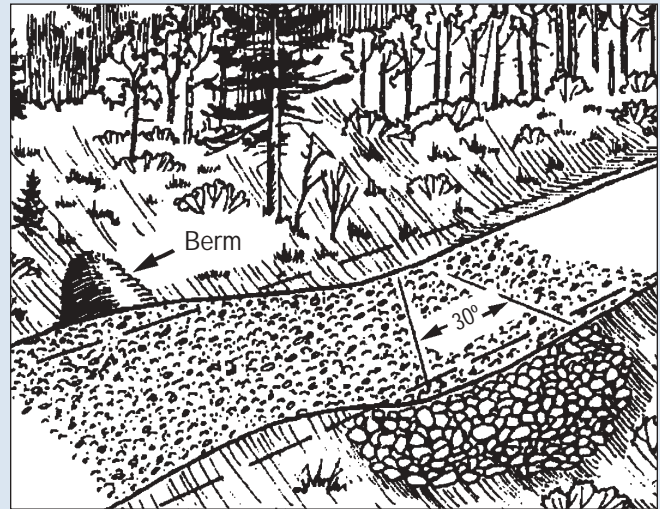


Figure 11-23: Broad-based dip (and cross-section).

## BMP: Waterbars

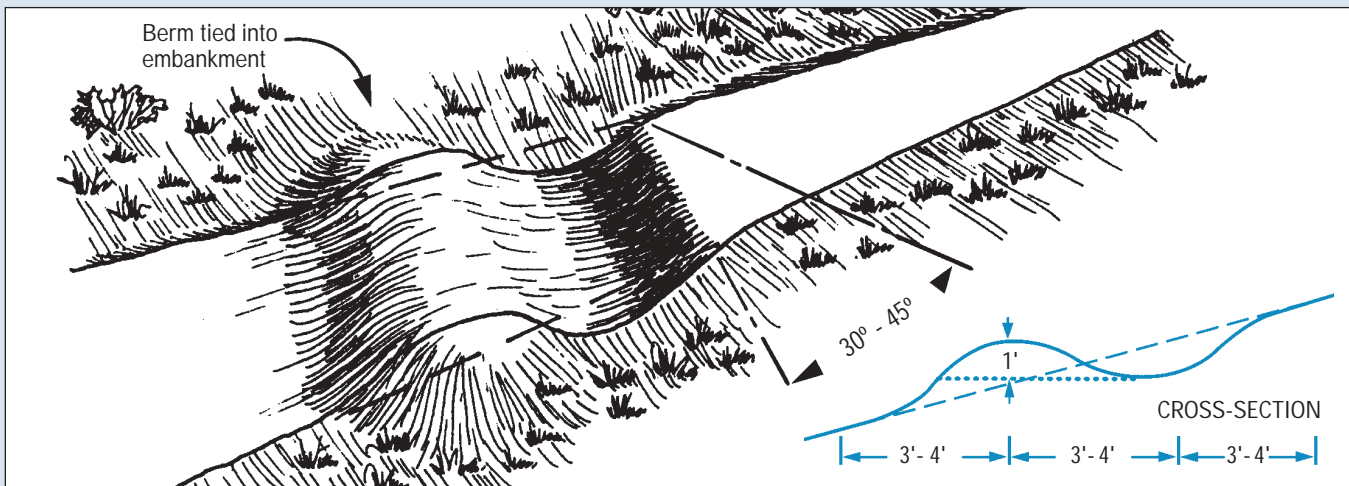


Figure 11-24: Waterbar.

A waterbar is a shallow trench with a mound (or berm) which provides cross-drainage and intercepts runoff from skid trails, recreational trails, firebreaks, or inactive or closed roads. Constructing a waterbar

will minimize erosion and provide conditions for natural or artificial revegetation (see Figure 11-24).

- ✓ Place waterbars at a 30° to 45° angle with a cross-drainage grade of two percent.

## SOIL STABILIZATION

Soil stabilization practices are used where soil is exposed, and natural revegetation is inadequate to prevent soil erosion and subsequent sedimentation into streams, lakes and wetlands. This occurs during road construction, and when the road system is being used (active) or is closed (inactive). Practices include mulching, seeding, and installing sediment control structures. References include the Wisconsin DNR's *Wisconsin Construction Site Erosion Control Handbook* and Chapter 10 in the *Wisconsin Department of Transportation's Erosion and Sediment Control Facilities Development Manual*. To obtain these references, see the Resource Directory. Contact a Wisconsin DNR forester or the USDA Natural Resources and Conservation Service for more information.

**It is always more efficient and cost-effective to prevent erosion than to repair damage after the fact.**

### Mulch and Seeding

Mulch such as straw, woodchips or bark, retains soil moisture important for seed germination, and protects the soil surface from erosion due to runoff and raindrop impact. Mulch can be used to: 1) promote natural revegetation or 2) protect seeds spread over an area. If you seed, apply mulch immediately afterward. Netting may be necessary to hold mulch in place on steep slopes or on areas where water flow concentrates.



*Figure 11-25: Once recommended as a wildlife planting, multiflora rose has become quite invasive in many locations.*

### BMP: Mulch and Seeding

- ✓ Use mulch and/or seed where necessary to minimize soil erosion into streams, lakes and wetlands.

Seed mixtures should include fast-growing species for quick soil protection, plus perennial species for longer soil protection until native vegetation returns to the site. Do not use mixtures that contain aggressive or non-native invasive species like reed canary grass, birds-foot trefoil, crown/hairy vetch, or tall fescue; use certified weed-free seed. Recommendations for seed mixes that are best for specific regions in Wisconsin are available from your local Wisconsin DNR Wildlife Management Specialist, and USDA Natural Resources and Conservation Service (NRCS) office. However, a suggested generic seed mixture, applied at the rate of 31 lbs./acre, is as follows:

White Dutch Clover .....	8 lbs./acre
Perennial Rye Grass.....	5 lbs./acre
Annual Rye Grass .....	8 lbs./acre
Creeping Red Fescue.....	10 lbs./acre
<b>Total .....</b>	<b>31 lbs./acre</b>

(Note: One acre equals 43,560 square feet.)

A list of seed mixtures based on physical site characteristics is contained within the technical guide critical area planting standard 342. This technical guide is available from USDA NRCS offices, or on-line at [www.wi.nrcs.usda.gov/fotg/standards4.asp](http://www.wi.nrcs.usda.gov/fotg/standards4.asp)

### BMP: Diversion Structures

Diversion ditches, or berms, divert water away from roads and side ditches, and channel it into vegetation. These structures are often used before stream crossings to ensure that water will be diverted into vegetation, and not directly into a stream, lake or wetland (see Figure 11-7, page 144).

- ✓ Construct diversion ditches so they intersect the roadside ditch at the same depth, and are outsloped one to three percent.



## BMP: Sediment-control Structures

- ✓ Install sediment-control structures where necessary to slow the flow of runoff, and trap sediment until vegetation is established at the sediment source. Sediment-control structures include straw bale fencing, silt fencing and sediment traps. Maintain, clean or replace sediment-control structures until areas of exposed soil are stabilized (see Figures 11-26, 11-27 and 11-28).

Figure 11-26: A sediment trap to slow runoff and trap sediment for channelized flow.

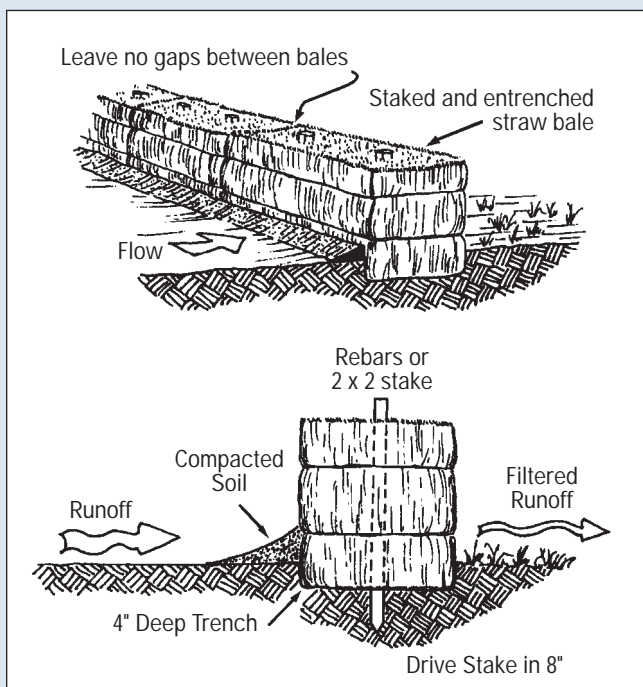


Figure 11-27: Straw bale fencing to slow runoff and trap sediment for sheet flow or channelized flow.

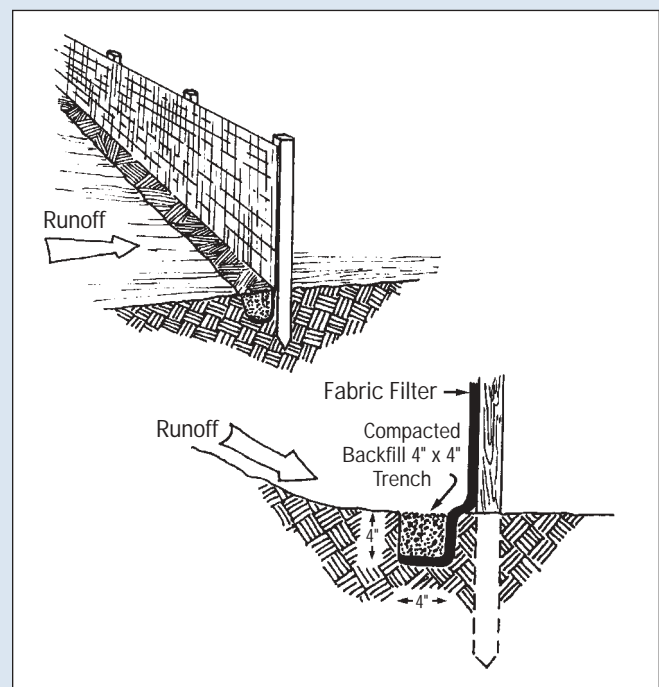


Figure 11-28: Silt fencing to slow runoff and trap sediment primarily for sheet flow, not channelized flow.

## WETLAND FOREST ROADS

## BMPs: Wetland Roads, Skid Trails and Landings

**Planning, Location and Design:  
Wetland Roads, Skid Trails  
and Landings**

Temporary roads, skid trails and landings require firm or frozen ground. Permanent roads in wetlands that require road-fill material must follow existing regulations, and be built carefully to avoid restricting the natural waterflow of the wetland under the road.

- ✓ Construct upland road approaches to wetlands so surface runoff is diverted away from the road and does not enter the wetland (see Drainage Structures, page 149).
- ✓ If landings are necessary in a wetland, build them to the minimum size required for the operation and to achieve the landowner's objective.
- ✓ Avoid operating equipment in areas of open water, springs or seeps.
- ✓ Provide for adequate cross-road drainage to minimize changes to natural surface and subsurface flow in the wetland.
  - For permanent fill roads, use permeable fill material for at least the first layer of fill, and install culverts or bridges a minimum of 300 feet apart and at all natural drainageways. Install at least one drainage structure at each wetland crossing.
  - For temporary roads, provide adequate cross-road drainage at all natural drainage ways. Temporary drainage structures include culverts, bridges and porous material such as corduroy or chunkwood. Temporary non-organic structures such as metal culverts and bridges, should be removed promptly when work is complete.

- ✓ Equipment operations should cease when rutting becomes excessive.
- ✓ Use low-ground pressure equipment such as wide-tire or tracked equipment, if necessary, to minimize rutting.
- ✓ Minimize rutting in wetlands by conducting forestry activities on firm or frozen ground that can support the equipment used. To achieve this:
  - Operate equipment on a day-to-day basis depending on weather conditions.
  - Consider using corduroy, chunkwood or rubber mats to improve the soil's ability to support traffic.

**IN THE WINTER:**

- To promote frost penetration, compact snow, grass, and brush.
- Monitor air temperatures daily. As air temperatures rise above freezing, you may not be able to operate equipment beyond late morning without creating ruts. Soil frost begins to disappear when night temperatures stay above freezing for three or four consecutive nights.

**IN THE SUMMER:**

- Operate equipment only when soils are dry enough to support equipment. Soils may become too wet after storms and extended wet spells.



## 15 FEDERAL REQUIREMENTS

### BMPs: Forest Roads in Wetlands

The following 15 BMPs must be implemented in order to qualify for the silvicultural exemption from a federal section 404 permit when building a temporary or permanent road or skid trail in a wetland (33 CFR Part 323.4). The silvicultural exemption is only applicable when the primary purpose of the road is for normal silvicultural purposes. This listing is an attempt to explain the 15 BMPs in layman's language. The exact language of the law may be obtained by contacting the Army Corps of Engineers.

- ✓ Limit the number, length and width of roads and skid trails to the minimum necessary to accomplish the landowner's objective.
- ✓ Locate roads outside riparian management zones except at stream crossings.
- ✓ Road fill must be bridged, culverted or otherwise designed to prevent restriction of expected flood flows.
- ✓ Properly stabilize and maintain road fill during and after road construction to prevent erosion.
- ✓ While building a road with fill material, minimize the use of road construction equipment in the wetland area that lies outside the boundaries of the road fill.
- ✓ Minimize disturbance of vegetation while designing, constructing and maintaining roads.
- ✓ Correctly design, construct and maintain wetland road crossings to avoid disrupting the migration or movement of fish and other aquatic life.
- ✓ Use fill from upland sources whenever feasible.
- ✓ Place fill in a way that does not take or jeopardize the continued existence of a threatened or endangered species (as defined under the Endangered Species Act) or adversely modify or destroy the critical habitat of such species.
- ✓ Avoid placing fill in breeding and nesting areas for migratory waterfowl, spawning areas, and wetlands if practical alternatives exist.
- ✓ Fill shall not be placed near a public water supply intake.
- ✓ Fill shall not be placed in areas of concentrated shellfish production.
- ✓ Fill shall not be placed in waterbodies or on land regarded as part of the National Wild and Scenic River System.
- ✓ Use fill free from toxic pollutants in toxic amounts.
- ✓ Completely remove all temporary fills and restore the area to its original elevation.

## ROAD MAINTENANCE

### BMPs: Road Maintenance

Roads must be well-maintained or water quality protection structures may quickly degrade. For both active and inactive roads, follow BMPs in Soil Stabilization, page 152).

#### ACTIVE ROADS

- ✓ Inspect the road system at regular intervals, especially after heavy rainfall, to detect problems and schedule repairs.
- ✓ Clear debris from culverts, ditches, dips, and other drainage structures to decrease clogging that can lead to washouts. Place the debris where it cannot be washed back into these structures or into open water.
- ✓ Keep traffic to a minimum during wet periods and spring breakup, to help reduce maintenance needs.
- ✓ Shape road surfaces periodically to maintain proper surface drainage. Fill in ruts and holes with gravel or compacted fill as soon as possible to reduce erosion potential.
- ✓ Remove berms along the edge of the road if they will trap water on the road.
- ✓ When dust control agents are used, apply them in a manner that will keep these compounds from entering lakes, streams and groundwater. Consult a qualified road engineer from the County Highway Commissioner's Office or Wisconsin Department of Transportation for assistance in selecting the appropriate chemicals and amounts. **Note: It is illegal to spread oil on roads, land or water in Wisconsin.**

#### INACTIVE ROADS

When forest roads are inactive for extended periods, closing the system will help to protect the road surface and the water quality protection structures. Consider erecting a barrier to traffic such as a gate or berm,

and post "Closed" signs at the entrance of temporarily closed roads. Stating the length of time and/or reason for closure, and inviting acceptable uses may be helpful to assure compliance.

- ✓ Remove all temporary drainage and stream crossing structures.
- ✓ Shape all road system surfaces to maintain proper surface drainage, if necessary.
- ✓ Install waterbars where necessary (see page 151 and follow the recommendations in Table 11-1 on page 149).
- ✓ Inspect and maintain road surfaces, permanent drainage and stream crossing structures (ditches, culverts, bridges, etc.) to minimize erosion.



*Figure 11-29: Maintaining woods roads helps prevent erosion. This grader is shaping the road surface so that water runs off properly.*